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Marine Protected Area Network Planning in the Scotian Shelf Bioregion: Context and Conservation Objectives

Planification du réseau d'aires marines protégées dans la biorégion du plateau néo-écossais : renseignements généraux et objectifs de conservation

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ABSTRACT

Canada has committed to establishing a national network of Marine Protected Areas (MPAs) in support of integrated coastal and ocean management. Fisheries and Oceans Canada (DFO) Maritimes Region is leading the development of an MPA network plan for the Scotian Shelf Bioregion. A Regional Canadian Science Advisory Secretariat meeting was held March 5-7, 2012, in Dartmouth, Nova Scotia, to gather advice from the science community on what ecosystem features (i.e., species, habitats, and communities) a network of MPAs for the Scotian Shelf Bioregion should aim to protect, and the data that should be considered in characterizing the spatial distribution of these features.

This research document was prepared as a context piece for that meeting. It is intended to: (1) outline the policy context for MPA network planning in Canada; (2) provide a summary of past MPA network planning efforts in the Scotian Shelf Bioregion; (3) set the Regional Science Advisory Process in the context of the broader network planning process; and (4) outline strategic-level conservation objectives for the bioregional network.

RÉSUMÉ

Le Canada s'est engagé à établir un réseau national d'aires marines protégées (AMP) en soutien à la gestion intégrée des côtes et des océans. La région des Maritimes de Pêches et Océans Canada (MPO) travaille à l'élaboration d'un plan de réseau d'AMP dans la biorégion du plateau néo-écossais. Une réunion régionale concernant l'avis scientifique a eu lieu du 5 au 7 mars 2012 à Dartmouth, en Nouvelle-Écosse. Elle avait pour objectifs de rassembler des avis sur les caractéristiques des écosystèmes (c.-à-d. espèces, habitats et communautés) que devrait chercher à protéger le réseau d'AMP dans la biorégion du plateau néo-écossais, de même que sur les données à prendre en considération pour déterminer la répartition spatiale de ces caractéristiques.

Ce document de recherche a été préparé pour donner des renseignements généraux utiles à cette réunion. Il doit servir à : 1) exposer dans les grandes lignes le contexte stratégique de la planification du réseau d'AMP au Canada; 2) résumer les efforts fournis par le passé à la planification du réseau d'AMP dans la biorégion du plateau néo-écossais; 3) fixer le processus d'avis scientifique régional dans le contexte d'un processus global de planification des réseaux; et 4) donner un aperçu des objectifs de conservation au niveau stratégique pour les réseaux des biorégions.

INTRODUCTION

Canada has committed to establishing a national network of Marine Protected Areas (MPAs) in support of integrated coastal and ocean management. Under the *Health of the Oceans (HOTO) Initiative*, Fisheries and Oceans Canada (DFO), along with federal and provincial partners, is responsible for coordinating the development of MPA network plans for each of Canada's 13 bioregions. DFO Maritimes Region is leading the development of an MPA network plan for the Scotian Shelf Bioregion, which generally corresponds to the current Maritimes Region boundaries.

A Regional Canadian Science Advisory Secretariat (CSAS) meeting was held March 5-7, 2012, in Dartmouth, Nova Scotia, to gather advice from the science community on what ecosystem features (i.e., species, habitats, and communities) a network of MPAs for the Scotian Shelf Bioregion should aim to protect, and the data that should be considered in characterizing the spatial distribution of these features. This document was prepared as a context piece for that meeting.

The meeting discussion focused on objectives, data inputs and general approach to identifying areas to be considered in the design of the network. It was not designed to be a review of the Horsman et al. (2011) MPA network analysis (herein referred to as the "*Marxan* analysis") but the appropriateness of the data layers that went in to the analysis were to be discussed.

The intent of this paper is to (1) outline the policy context for MPA network planning in Canada; (2) provide a summary of past MPA network planning efforts in the Scotian Shelf Bioregion; (3) set the Regional Science Advisory Process in the context of the broader network planning process; and (4) outline strategic-level conservation objectives for the bioregional network.

POLICY CONTEXT

CANADA'S COMMITMENTS TO MARINE PROTECTED AREA NETWORKS

Canada has made several international and domestic commitments to establishing networks of MPAs (see Government of Canada 2011 for a full list). Most recently at the international level, the 2010 Conference of the Parties to the Convention on Biological Diversity (CBD) reaffirmed the commitment to the implementation of a global network of MPAs, this time with a 2020 timeline and a global target of "at least... 10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services... conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures... integrated into the wider landscape and seascape." Domestic commitments have been made through the *Oceans Act*, *Canada's Federal Marine Protected Areas Strategy* (Government of Canada 2005), and the federal HOTO Initiative, which aimed to develop network plans by 2012.

In September 2011, as part of the HOTO Initiative, Canada's federal, provincial and territorial members of the Canadian Council of Fisheries and Aquaculture Ministers (all except Nunavut) approved the policy document *National Framework for Canada's Network of MPAs* (herein referred to as the *National Framework*). This now provides strategic direction for the design of a national network of MPAs that is to be planned and implemented through component bioregional networks. The Scotian Shelf Bioregion, which includes the Shelf, the Bay of Fundy and the Canadian portion of the Gulf of Maine, is one of 13 Canadian bioregions. Moving forward, DFO is the lead agency and will work closely with Environment Canada and Parks

Canada (the two other federal agencies with MPA mandates) and the provinces and territories to design networks of MPAs in each of the bioregions in order to form the national network.

GUIDANCE FOR BIOREGIONAL NETWORK DESIGN

Guidance on bioregional MPA network planning and design is set out in the *National Framework* (Government of Canada 2011) and the DFO Science Advisory Report 2009/061, *Science Guidance on the Development of Networks of Marine Protected Areas* (DFO 2010). Both documents recommend that bioregional planning follow the technical guidance on establishing MPA networks provided by the CBD in the Conference of the Parties (COP) 9 Decision IX/20, including annexes I-III[1].

The CBD guidance states that effective networks should include the following properties and components: Ecologically and Biologically Significant Areas (EBSAs), representativity, connectivity, replicated ecological features, and adequate and viable sites (Annex II). In essence, the guidance indicates that networks should protect EBSAs and representative examples of all ecosystem or habitat types through individual MPAs that are connected through ecological processes and of sufficient size and protection level. Annex III of the CBD guidance suggests that the initial steps in designing networks of MPAs are to: (1) identify EBSAs; and (2) select or develop a suitable biogeographic, habitat, or community classification system that can be used as a basis for representativity.

Both DFO (2004, 2011) and the CBD (Annex I) provide guidance on the identification of EBSAs and although they are slightly different, it is generally accepted that following either the DFO or CBD EBSA criteria will result in the identification of similar areas. However, the CBD EBSA criteria will be used for this process because the eventual network design will be shared by other federal and provincial government agencies, and possibly the United States in the Gulf of Maine.

CBD guidance at a glance (from COP 9 Decision IX/20, summarized in CBD 2009):

- Annex III states that the initial two steps in network planning should be to:
    1. Identify EBSAs.
    2. Select or develop an ecosystem or habitat classification system that will serve as a basis for considering representativity.
- Annex I outlines scientific criteria for identifying EBSAs:
    1. Uniqueness or rarity.
    2. Special importance for life history stages of species.
    3. Importance for threatened, endangered or declining species and/or habitats.
    4. Vulnerability, fragility, sensitivity or slow recovery.
    5. Biological productivity.
    6. Biological diversity.
    7. Naturalness.
- Representative areas: The Azores Report (CBD 2007) gives some guidance on how to include representation to protect biodiversity and maintain ecological integrity. At the most basic level, it means capturing the full range of ecosystems and habitat diversity found in a planning area. Ecosystems or habitats must be classified and delineated throughout a bioregion to consider representation at this scale.

[1] The 2008 COP 9 decision IX/20 and all annexes available at: http://www.cbd.int/decision/cop/?id=11663.

TERMINOLOGY AND DEFINITIONS

Marine Protected Area: For the purposes of this process, an MPA is defined as "A clearly defined geographical space recognized, dedicated, and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (International Union for Conservation of Nature (IUCN)/World Commission on Protected Areas (WCPA) definition as cited in Dudley 2008). It is important to recognize that in using this definition, a wide range of protected area designations could quality as MPAs. In looking at DFO-administered areas, an *Oceans Act* MPA would clearly fit the definition as could the two Coral Conservation Areas designated in the Scotian Shelf Bioregion through the *Fisheries Act*. Other fisheries closures that provide some protection for specific species, yet allow fishing for other species are generally not considered MPAs in a formal sense (e.g., the Lobster Fishing Area 40 closure, which is closed for lobster but not other fisheries). Fisheries closures will be examined on a case by case basis to determine whether they contribute to objectives of the bioregional MPA network. Other federal designations, such as Parks Canada's National Marine Conservation Areas and certain Canadian Wildlife Service (CWS) National Wildlife Areas would qualify under this definition. DFO and its partners are currently developing criteria for what "is" and what "is not" an MPA within the context of the national network. The IUCN system for describing different levels of protection and/or management objectives associated with protected areas will be taken into account in this process (Hastings 2011).

Marine Protected Area Network: Canada has adopted the IUCN definition of a network of MPAs (in Dudley 2008), which is "A collection of individual marine protected areas that operates cooperatively and synergistically, at various spatial scales, and with a range of protection levels, in order to fulfill ecological aims more effectively and comprehensively than individual sites could alone."

Ecologically and Biologically Significant Areas (EBSAs): EBSAs are spatially defined areas that provide important services either to one or more species or populations in an ecosystem, or to the ecosystem as a whole. An area must meet one or more specific criteria to be considered an EBSA. Although DFO and the CBD both offer detailed guidance and criteria for identifying EBSAs (see Table 1 for comparison), the areas identified through the application of either criterion are expected to be very similar. The CBD EBSA criteria will be used in designing a network of MPAs in the Scotian Shelf Bioregion.

CBD EBSA (CBD 2009)	DFO EBSA (DFO 2004)				
	Uniqueness	Aggregation	Fitness Consequences	Naturalness	Resilience
Uniqueness or rarity					
Important to life history stages					
Species at Risk habitat or aggregations					
Vulnerability					
Productivity					
Biodiversity					
Naturalness					

Table 1. Comparison of CBD (rows) and DFO (columns) EBSA criteria. Gray areas indicate overlap between criteria.

Ecologically Significant Species (ESS): An ESS is a species that has particularly high ecological or biological significance due to its role in the ecosystem as, for example, an influential predator, important forage species or a structure providing species (DFO 2006, 2007).

Depleted Species (DS): A DS is a species that is currently at very low abundance, and usually was much more abundant at some time in the past (DFO 2007). More specifically, a DS is listed under the *Species at Risk Act* or Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Endangered or Threatened, or is below the 'critical cautious' reference point in DFO's Precautionary Approach Framework (DFO 2007).

Representation: Representation is achieved by protecting examples of the full range of biogeographic units in a particular planning area. Representation (or representativity) can be considered at different spatial scales ranging from broader biogeographic regions (e.g., Parks Canada Marine Regions) to finer-scale habitats or communities. MPA network planning at the bioregional level will focus on achieving representation at the ecosystem, habitat or community scale. Classification systems that delineate ecosystems or habitats, such as the Kostylev and Hannah (2007) benthic habitat model, are required to consider representation in the network design.

SUMMARY OF NETWORK PLANNING EFFORTS IN THE SCOTIAN SHELF BIOREGION TO DATE

It is imperative to note that MPA network planning in the bioregion aims to build on existing work, and complement work to date wherever possible. In fact, much work has been carried out over the past decade that is extremely relevant and useful moving forward. Some examples include:

- Report from the Roundtable on MPA network planning (Fenton and Westhead 2000).
- EBSA identification in the Scotian Shelf offshore and inshore areas (Doherty and Horsman 2007), and Bay of Fundy (Buzeta et al. 2003; Buzeta and Singh 2008).
- Benthic Classification Workshops (Benthic Regional Science Advisory Processes I and II) (DFO 2002, 2005).
- Compilation of ecological and human use information for twenty coastal sites (Gromack et al. 2010).
- Eastern Scotian Shelf Integrated Management Plan (DFO 2007).
- DFO's 2008 *Marxan* analysis (Horsman et al. 2011).
- Ecological overview reports for the Gulf of Maine (East Coast Aquatics 2011), Minas Basin (Parker et al. 2007a), Scotian Shelf (Breeze et al. 2002; Breeze 2004), and the Bras d'Or Lakes (Parker et al. 2007b).

The most significant contribution to MPA network planning in the region to date is the Horsman et al. (2011) *Report on MPA Network Analysis for the Maritimes Region of Canada*. This two-year project focused primarily on the offshore areas of the Maritimes Region to systematically identify sites that would contribute to an MPA network. The approach was based on guidance from the CBD, incorporated the best available ecological data, and used the conservation planning software *Marxan* to identify spatially efficient network design scenarios that met a suite of conservation targets. This was the first government-led, systematic and data-driven marine spatial conservation planning exercise to be completed for the region. The results informed the selection of the St Anns Bank Area of Interest and initiated an important dialogue on network design in the bioregion. The current process will build on this work. Moving forward, a similar approach is proposed using revised objectives and updated data.

Due to varying levels of available ecological data across the Scotian Shelf Bioregion, different approaches to identifying EBSAs and delineating representative marine ecosystems are required for three distinct planning areas: (1) the offshore Scotian Shelf; (2) the Atlantic coast of Nova Scotia; and (3) the Bay of Fundy. Figure 1 shows an approximation of these planning areas; however, refinement of the boundaries will be required in future. The offshore planning area is particularly complex as it includes the Scotian Shelf, the Scotian Slope, the deep abyssal plain, parts of the Gulf of Maine, and the Canadian portion of Georges Bank. Despite different approaches, the same guiding principles for the planning process and overarching conservation objectives for the network (i.e., EBSAs and representation) will be applied to all planning areas.

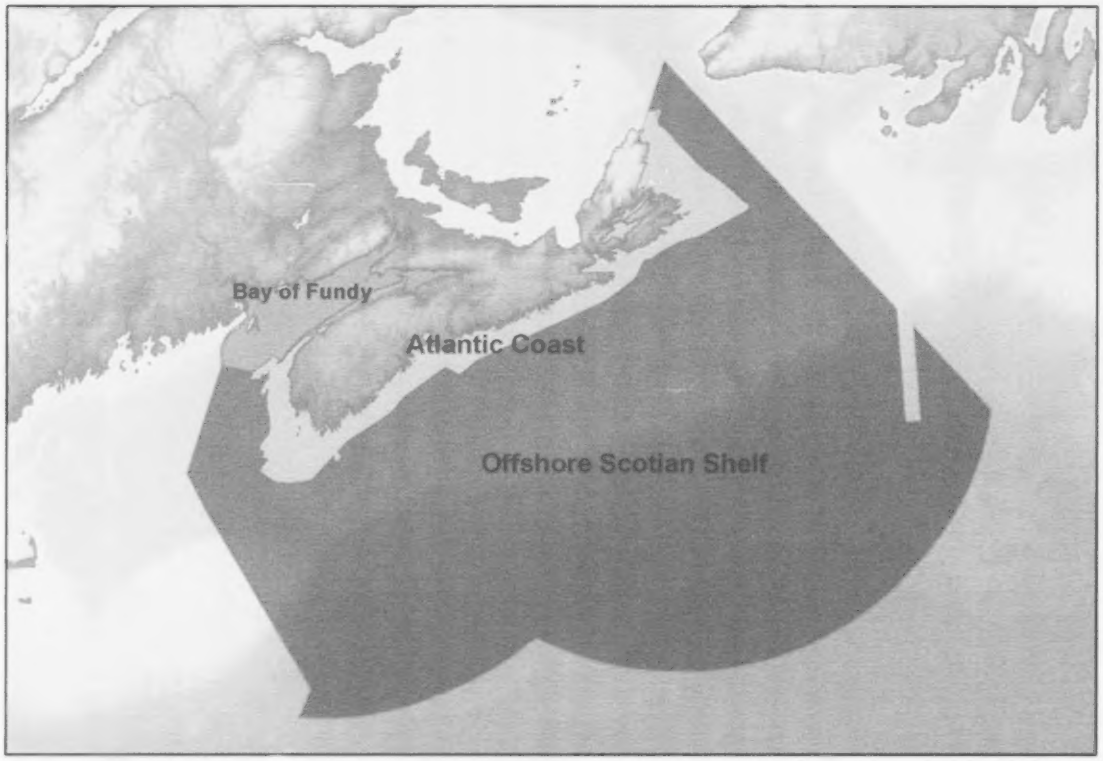

Figure 1. Map showing approximation of the proposed planning areas for the Scotian Shelf Bioregion: the Bay of Fundy (orange), the Atlantic Coast (pink), and the offshore (remaining).

BROADER BIOREGIONAL NETWORK PLANNING CONTEXT

The MPA network planning process developed and agreed upon by federal and provincial/territorial agencies in the *National Framework* includes the following steps:

1. Identify and involve stakeholders (governments, stakeholders, etc.).
2. Compile available information (scientific, traditional, economic, community, etc.).
3. Set clear, measurable network objectives and conservation targets.
4. Apply network design features and properties, identify areas of high conservation value, and perform gap analysis.
5. Consider potential economic and social impacts: finalize network design.
6. Create and finalize a bioregional action plan to implement sites.
7. Undertake site-specific planning and implementation.
8. Manage and monitor the MPA network.

The network planning process proposed for the Scotian Shelf Bioregion will generally follow these major steps, although Maritimes Region has proposed a slightly modified six-step process outlined below (Figure 2). Figure 2 also shows specifically where science advice will be required throughout the MPA network planning process. The March 2012 meeting was 'Phase I', and contributed to both steps two and three, setting objectives and compiling data.

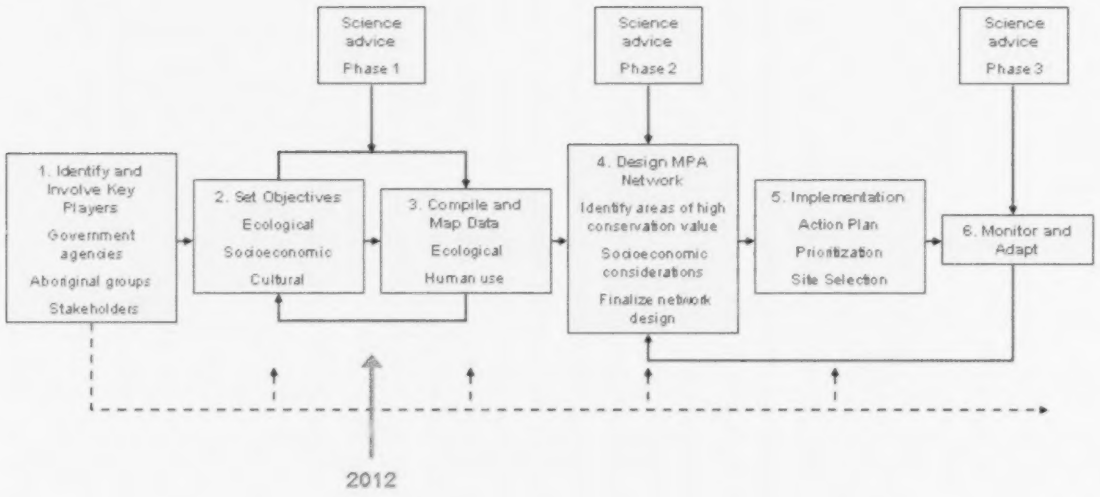

Figure 2. Proposed MPA network planning process for the Scotian Shelf Bioregion.

Although the focus of the March 2012 meeting is on conservation objectives and ecological data, it is important to note that cultural and socio-economic values will also be carefully considered in the network planning process. The Oceans and Coastal Management Division is in the process of mapping use patterns and important areas for all ocean sectors in the bioregion. Human use analysis will also provide information on interactions and risks posed by various activities to the marine ecosystem, and identify existing management/mitigation measures and best-fit management approaches. Consultation with various sectors and interest groups will be used to review and validate information and methods used for mapping and analysis.

As outlined in the *National Framework*, the following six guiding principles will be followed as Canada moves forward in developing a network of MPAs (Government of Canada 2011):

1. Coherent approach: ensure that MPA networks are linked to broader oceans management initiatives, including those in adjacent marine and terrestrial areas.
2. Respect existing rights and activities: includes federal, provincial, territorial, Aboriginal, and First Nations.
3. Open and transparent process: including partnerships, participation, consultation, timely information exchange and public awareness.
4. Consider socio-economics: use human use and socio-economic information to design a cost-effective network that minimizes socio-economic impacts.
5. Apply appropriate protection: in order to achieve network goals, ensure the appropriate level of protection is put in place.
6. Apply best management practices: including precautionary approach, sustainable development, ecosystem approach to management, adaptive management, etc.

The March 2012 CSAS meeting was part of a three-phased/multi-year Regional Science Advisory Process (see Figure 2):

- Phase 1: Review objectives, data and work to date (March 2012).
- Phase 2: Review specific targets, network design analysis methods, and resulting priority areas.
- Phase 3: Monitoring and evaluation.

Implementation of the network, or site designations, will be a collaborative effort between the relevant federal and provincial departments. Implementation will also be dependent on funding and resources available. When the list of priority areas for the network is produced, it will be necessary to examine each individual area to determine the appropriate management measure in order to achieve effective protection (i.e., the appropriate level of protection is afforded). It will also be necessary to determine the level of threat to each area in order to help prioritize designations. For some areas, a *Fisheries Act* closure may be appropriate, others may require an *Oceans Act* MPA designation, and others may be more appropriate for other government departments such as the CWS or Parks Canada, which have specific criteria and processes for identifying priority areas.

An MPA Network Action Plan will be developed for the Scotian Shelf Bioregion that reflects the priorities of all relevant federal and provincial agencies. Determining the appropriate designation and protection level will depend on many factors, such as the sensitivity of the target species and ecosystem, the degree of threat to the area, and potential socio-economic costs. It is generally recognized that the benefits of MPAs increase with the degree of protection they provide. Therefore, the core components of the network should have a high degree of protection. It is important to note that not all EBSAs will require protection through MPA designation. Those that are not part of the final network plan may be subject to other management measures to ensure they continue to provide the ecosystem services that resulted in their identification.

DRAFT ECOLOGICAL OBJECTIVES FOR A NETWORK OF MPAS IN THE SCOTIAN SHELF BIOREGION

The *National Framework* (Government of Canada 2011) outlines the following high-level goals for the National Network:

1. To provide long-term protection of marine biodiversity, ecosystem function and special natural features.
2. To support the conservation and management of Canada's living marine resources and their habitats, and the socio-economic values and ecosystem services they provide.
3. To enhance public awareness and appreciation of Canada's marine environments and rich maritime history and culture.

Emerging national guidance recommends the development of strategic objectives at the bioregional level under each of the three national goals. Discussion at the March 2012 meeting focused on the proposed conservation objectives under Goal 1, which is recognized as the primary goal of the network (Government of Canada 2011).

Based on the CBD guidance, DFO Maritimes Region is proposing the two strategic conservation objectives for the network of MPAs in the Scotian Shelf Bioregion (below). Each strategic objective will be broken down into more specific conservation objectives and targets that outline the ecosystem features (i.e., species, habitats and communities) the network will aim to protect

in each of the three planning areas. The CBD EBSA criteria will be used as the basis for setting specific conservation objectives and targets under the Strategic Objective 1. More specific conservation objectives and targets will be defined under Strategic Objective 2 based on the habitat classification systems being used in the different planning areas.

Strategic Objective 1: Protect EBSAs and other special natural features in the Scotian Shelf Bioregion that may benefit from long-term, year-round, spatial management.

Examples of more specific conservation objectives:

- Protect areas with unique or rare ecological functions, processes or natural features on an international, national, regional, or sub-regional scale.
    - e.g., the only known *Lophelia pertusa* reef in the Northwest Atlantic.
- Protect areas that are of special importance for the life history stages of species.
    - e.g., spawning or nursery areas for ecologically significant species.
- Protect areas that are important for threatened, endangered or declining species and/or habitats.
    - e.g., feeding areas for the endangered North Atlantic Right Whale.
- Protect areas that contain a relatively high proportion of vulnerable species, habitats or communities.
    - e.g., concentrations of coldwater corals (parts of the Northeast Channel).
    - e.g., concentrations of Russian Hat sponges (parts of Emerald Basin).
- Protect areas of high biological diversity.
    - e.g., areas of particularly high species richness/diversity.
- Protect areas of high biological productivity.
    - e.g., areas of high primary productivity.
    - e.g., coastal eel grass beds.
- Protect areas of high naturalness (highly intact areas).
    - e.g., areas that have not been disturbed by human activities.

Strategic Objective 2: Protect representative examples of all marine ecosystem and habitat types in the Scotian Shelf Bioregion based on coastline, coastal subtidal and offshore classifications, along with their associated biodiversity and ecological processes.

Examples of more specific conservation objectives:

- Protect representative examples of all seabed feature types (banks, basins, channels, slope, etc.) in the bioregion.
- Protect representative examples of all coastal habitat types.

REFERENCES

Breeze, H. 2004. Review of Criteria for Selecting Ecologically Significant Areas of the Scotian Shelf and Slope: A discussion paper. Oceans and Coastal Management Report 2004-04. DFO, Dartmouth, NS. 88 p. Available at [Internet]: http://www.dfo-mpo.gc.ca/Library/283936.pdf (accessed February 22, 2012).

Breeze, H., D.G. Fenton, R.J. Rutherford, and M.A. Silva. 2002. The Scotian Shelf: An Ecological Overview for Ocean Planning. Can. Tech. Rep. Fish. Aquat. Sci. 2393: x + 249 p.

Buzeta, M-I., and R. Singh. 2008. Identification of Ecologically and Biologically Significant Areas in the Bay of Fundy, Gulf of Maine. Volume 1: Areas Identified for Review, and Assessment of the Quoddy Region. Can. Tech. Rep.Fish. Aquat. Sci. 2788: vii + 80 p.

Buzeta M-I, R. Singh, and S. Young-Lai. 2003. Identification of Significant Marine and Coastal Areas in the Bay of Fundy. Can. Man. Rep. Fish. Aquat. Sci. 2635: 246 p.

CBD. 2007. Report of the Expert Workshop on Ecological Criteria and Biogeographical Classification Systems for Marine Areas in Need of Protection. Azores, Portugal, 2-4 October 2007. UNEP/CBD/EWS.MPA/1/2.

CBD. 2009. Azores Scientific Criteria and Guidance. Available at [Internet]: http://www.cbd.int/marine/doc/azores-brochure-en.pdf (accessed February 22, 2012).

DFO. 2002. A Framework for the Conservation of Benthic Communities of the Scotia-Fundy Area of the Maritimes Region. Proceedings of a Benthic Classification Workshop. Meeting of the Maritimes Regional Advisory Process, June 25-26, 2001. Bedford Institute of Oceanography, Dartmouth, NS. 93 p. Available at [Internet]: http://www.dfo-mpo.gc.ca/csas/Csas/proceedings/2002/PRO2002_023e.pdf (accessed February 22, 2012).

DFO. 2004. Identification of Ecologically and Biologically Significant Areas. DFO Can. Sci. Advis. Sec. Ecosystem Status Rep. 2004/006.

DFO. 2005. Framework for Classification and Characterization of Scotia-Fundy Benthic Habitats. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2005/071.

DFO. 2006. Identification of Ecologically Significant Species and Community Properties. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2006/041.

DFO. 2007. Guidance Document on Identifying Conservation Priorities and Phrasing Conservation Objectives for Large Ocean Management Areas. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2007/010.

DFO. 2010. Science Guidance on the Development of Networks of Marine Protected Areas (MPAs). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/061.

DFO. 2011. Ecologically and Biologically Significant Areas – Lessons Learned. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2011/049.

Doherty, P., and T. Horsman. 2007. Ecologically and Biologically Significant Areas of the Scotian Shelf and Environs: A Compilation of Scientific Expert Opinion. Can. Tech. Rep. Fish. Aquat. Sci. 2774: 57 + xii p.

Dudley, N. (Editor). 2008. Guidelines for Applying Protected Area Management Categories. Gland, Switzerland: IUCN. Available at [Internet]: http://data.iucn.org/dbtw-wpd/edocs/PAPS-016.pdf (accessed February 22, 2012).

East Coast Aquatics. 2011. Gulf of Maine Ecosystem Overview. Can. Tech. Rep. Fish. Aquat. Sci. 2946: xvi + 203 p.

Fenton, D.G., and M.C. Westhead. 2000. Report from the Roundtable on Marine Protected Area System Planning. Can. Manuscr. Rep. Fish. Aquat. Sci. 2515: vi + 31 p.

Government of Canada. 2005. Canada's Federal Marine Protected Areas Strategy. Fisheries and Oceans Canada, Ottawa, On. 18 p. Available at [Internet]: http://www.dfo-mpo.gc.ca/oceans/publications/fedmpa-zpmfed/pdf/mpa-eng.pdf (accessed February 22, 2012).

Government of Canada. 2011. *National Framework* for Canada's Network of Marine Protected Areas. Fisheries and Oceans Canada, Ottawa, On. 31 p. Available at [Internet]: http://www.dfo-mpo.gc.ca/oceans/publications/dmpaf-eczpm/docs/framework-cadre2011-eng.pdf (accessed February 22, 2012).

Gromack, A.G, K. Allard, D. Fenton, S. Johnston, and J. Ford. 2010. Ecological and human use information for twenty areas on the Atlantic coast of Nova Scotia in support of conservation planning. Can. Tech. Rep. Fish. Aquat. Sci. 2880: xiv + 226 p.

Hastings, K. 2011. Engaging stakeholders in marine conservation planning: recommendations for moving forward with a bioregional MPA network on the Scotian Shelf. Thesis (M.Sc.). Dalhousie University, Halifax, NS. x + 101 p.

Horsman, T., A. Serdynska, K. Zwanenburg, and N. L. Shackell. 2011. Report on marine protected area network analysis for the Maritimes Region of Canada. Can. Tech. Rep. Fish. Aquat. Sci. 2917: xi + 188 p.

Kostylev, V.E., and C.G. Hannah. 2007. Process-driven characterization and mapping of seabed habitats. In Mapping the Seafloor for Habitat Characterization. Edited by B.J. Todd and H.G. Greene. Geol. Assoc. Can. Spec. Pap. 47: 171-184.

Parker, M., M. Westhead, and A. Service. 2007a. Ecosystem Overview and Assessment Report for the Minas Basin, Nova Scotia. Oceans and Coastal Management Document Series 2007-05.

Parker, M., M. Westhead, P. Doherty, and J. Naug. 2007b. Ecosystem Overview and Assessment Report for the Bras d'Or Lakes, Nova Scotia. Can. Manuscr. Rep. Fish. Aquat. Sci. 2789: xxii + 223 p.